

WHAT IS CLAIMED IS:

1. A process for producing a coloring material, comprising the steps of: providing a solution comprising (1) a soluble pigment precursor which is convertible into an insoluble pigment, (2) a solvent capable of dissolving the soluble pigment precursor therein, and (3) a stabilizing agent comprising an organic compound having a structure or a functional group capable of stabilizing the dispersibility of the insolubilized pigment in the solvent; and converting said soluble pigment precursor into an insoluble pigment to obtain the coloring material containing the insolubilized pigment dispersed stably in the solvent.

2. The process according to claim 1, further comprising the step of concentrating the resultant coloring material to obtain a solidified coloring material.

3. The process according to claim 2, further comprising the step of dispersing the resultant solidified coloring material in a solvent.

4. The process according to claim 1, wherein the conversion of the soluble pigment precursor into the insoluble pigment is carried out by a chemical method, a thermal method, a photolytic method, or a radiation induced method or a combination thereof.

5. The process according to claim 1, wherein the insoluble pigment has a polar group selected from the group consisting of a primary amine, a secondary amine, a cyclic amine, and a hydroxy group.

6. The process according to claim 1, wherein the stabilizing agent has a group selected from the group consisting of $>CO$, $-NH_2$, $>NH$, $>N-$, $=N^+<$, $-CONH_2$, $-CONH-$, $-NHCOO-$, $>NCOO-$, $-NHCONH-$, $(-NHCO)_2N-$, and $-OH$.

7. The process according to claim 1, wherein the stabilizing agent has an amine value.

8. The process according to claim 1, wherein the stabilizing agent has an amine value and an acid value, the amine value being greater than the acid value.

9. The process according to claim 1, wherein the stabilizing agent has an amine value of from 1 to 230 mg-KOH/g.

10. The process according to claim 1, wherein the stabilizing agent has a urethane bond.

11. The process according to claim 1, wherein the stabilizing agent has a molecular weight of not more than 20,000.

12. The process according to claim 1, wherein the stabilizing agent has 0.1 to 20 reactive double bond groups per molecule on average.

13. A coloring material produced by the process according to any one of claims 1, 2, and 3, for use in a color filter.

14. A coloring material comprising an adduct formed by interaction between (1) an insoluble pigment produced by conversion from a soluble pigment precursor and (2) a stabilizing agent comprising an organic compound having a structure or a functional group capable of stabilizing the dispersibility of the insolubilized pigment in a solvent.

15. The coloring material according to claim 14, wherein the adduct is dispersed in the solvent.

16. The coloring material according to claim 14, wherein the insoluble pigment has a polar group selected from the group consisting of a primary amine, a secondary amine, a cyclic amine, and a hydroxy group.

17. The coloring material according to claim 14, wherein the stabilizing agent has a group selected from the group consisting of $>CO$, $-NH_2$, $>NH$, $>N-$, $=N^+<$, $-CONH_2$, $-CONH-$, $-NHCOO-$, $>NCOO-$, $-NHCONH-$, $(-NHCO)_2N-$, and $-OH$.

18. The coloring material according to claim 14, wherein the stabilizing agent has an amine value.

19. The coloring material according to claim 14, wherein the stabilizing agent has an amine value and an acid value, the amine value being greater than the acid value.

20. The coloring material according to claim 14, wherein the stabilizing agent has an amine value of from 1 to 230 mg-KOH/g.

21. The coloring material according to claim 14, wherein the stabilizing agent has a urethane bond.

22. The coloring material according to claim 14, wherein the stabilizing agent has a molecular weight of not more than 20,000.

23. The coloring material according to claim 14, wherein the stabilizing agent has 0.1 to 20 reactive double bond groups per molecule on average.

24. The coloring material produced by the process according to claim 14, for use in a color filter.

25. A color filter comprising a colored layer as colored pixels provided on a transparent substrate, said colored layer containing a coloring material, said coloring material being produced by providing a solution comprising (1) a soluble pigment precursor which is convertible into an insoluble pigment, (2) a solvent capable of dissolving the soluble pigment precursor therein, and (3) a stabilizing agent comprising an organic compound having a structure or a functional group capable of stabilizing the dispersibility of the insolubilized pigment in the solvent, and converting said soluble pigment precursor into an insoluble pigment.

26. The color filter according to claim 25, wherein said colored layer comprises a light transparent resin with the insoluble pigment produced from the coloring material being dispersed therein.

27. The color filter according to claim 26, wherein said transparent resin is a negative-working resist or positive-working resist or a polymer or a prepolymer which can be structured by crosslinking, polymerization, or depolymerization induced by applying an ionizing radiation.

28. The color filter according to claim 25, wherein the coloring material is a solidified coloring material produced by, after the conversion of the soluble pigment precursor in the solution to the insoluble pigment, concentrating the resultant coloring material to solidify the coloring material.

29. The color filter according to claim 28, wherein said colored layer is formed of a coating produced from the solidified coloring material dispersed in a solvent.

30. The color filter according to claim 25, wherein, in the coloring material, the conversion of the soluble pigment precursor into the insoluble pigment is carried out by a chemical method, a thermal method, a photolytic method, or a radiation

induced method or a combination thereof.

31. The color filter according to claim 25, wherein, in the coloring material, the insoluble pigment has a polar group selected from the group consisting of a primary amine, a secondary amine, a cyclic amine, and a hydroxy group.

32. The color filter according to claim 25, wherein, in the coloring material, the stabilizing agent has a group selected from the group consisting of $>CO$, $-NH_2$, $>NH$, $>N-$, $=N^+<$, $-CONH_2$, $-CONH-$, $-NHCOO-$, $>NCOO-$, $-NHCONH-$, $(-NHCO)_2N-$, and $-OH$.

33. The color filter according to claim 25, wherein, in the coloring material, the stabilizing agent has an amine value.

34. The color filter according to claim 25, wherein, in the coloring material, the stabilizing agent has an amine value and an acid value, the amine value being greater than the acid value.

35. The color filter according to claim 25, wherein, in the coloring material, the stabilizing agent has an amine value of from 1 to 230 mg-KOH/g.

36. The color filter according to claim 25, wherein, in the coloring material, the stabilizing agent has an urethane bond.

37. The color filter according to claim 25, wherein, in the coloring material, the stabilizing agent has a molecular weight of not more than 20,000.

38. The color filter according to claim 25, wherein, in the coloring material, the stabilizing agent has 0.1 to 20 reactive double bond groups per molecule on average.

39. A color filter comprising a colored layer as colored pixels provided on a transparent substrate, said colored layer containing a coloring material, said coloring material comprising an adduct formed by interaction between (1) an insoluble pigment produced by conversion from a soluble pigment precursor and (2) a stabilizing agent comprising an organic compound having a structure or a functional group capable of stabilizing the dispersibility of the insolubilized pigment in a solvent.

40. The color filter according to claim 39, wherein said colored layer comprises a light transparent resin with the

insoluble pigment produced from the coloring material being dispersed therein.

41. The color filter according to claim 39, wherein said transparent resin is a negative-working resist or positive-working resist or a polymer or a prepolymer which can be structured by crosslinking, polymerization, or depolymerization induced by applying an ionizing radiation.

42. The color filter according to claim 39, wherein, in the coloring material, the adduct is dispersed in the solvent.

43. The color filter according to claim 39, wherein, in the coloring material, the insoluble pigment has a polar group selected from the group consisting of a primary amine, a secondary amine, a cyclic amine, and a hydroxy group.

44. The color filter according to claim 39, wherein, in the coloring material, the stabilizing agent has a group selected from the group consisting of $>CO$, $-NH_2$, $>NH$, $>N-$, $=N^+<$, $-CONH_2$, $-CONH-$, $-NHCOO-$, $>NCOO-$, $-NHCONH-$, $(-NHCO)_2N-$, and $-OH$.

45. The color filter according to claim 39, wherein, in the coloring material, the stabilizing agent has an amine value.

46. The color filter according to claim 39, wherein, in the coloring material, the stabilizing agent has an amine value and an acid value, the amine value being greater than the acid value.

47. The color filter according to claim 39, wherein, in the coloring material, the stabilizing agent has an amine value of from 1 to 230 mg-KOH/g.

48. The color filter according to claim 39, wherein, in the coloring material, the stabilizing agent has an urethane bond.

49. The color filter according to claim 25 or 39, wherein the insoluble pigment contained in the colored pixel of the color filter has an average particle diameter in the range of from 1 to 300 nm and a particle diameter distribution such that diameters of particles constituting the insoluble pigment are within $\pm 30\%$ of the average particle diameter and not more than 5% by weight of all the particles are accounted for by particles having a diameter of not less than 300 nm.

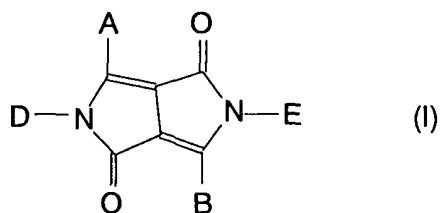
50. The color filter according to claim 25 or 39, wherein

the content of the insoluble pigment in the colored pixel of the color filter is in the range of from 10 to 90% by weight on a solid basis.

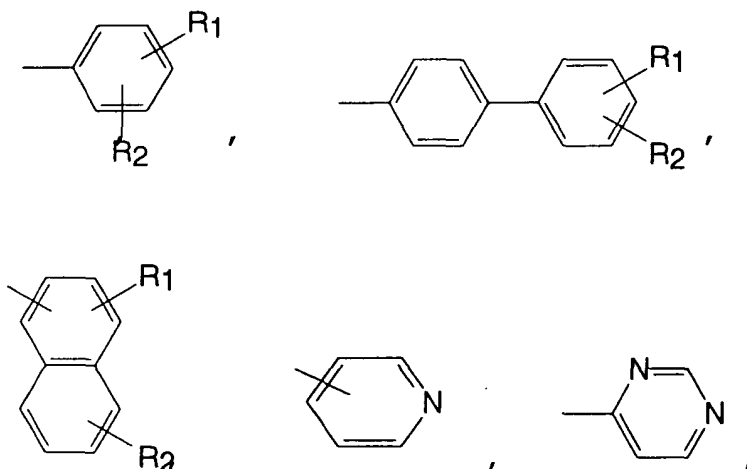
51. The color filter according to claim 25 or 39, wherein the colored pixel of the color filter has a contrast of not less than 2,000.

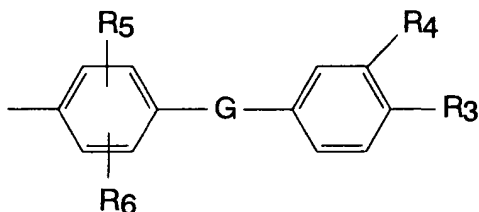
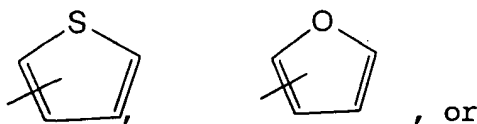
52. The color filter according to claim 25 or 39, wherein, in a spectral characteristic curve in a visible region of the colored pixel of the color filter, the light transmittance in its light absorption region is in the range of from 0 to 20% while the light transmittance in its light transmission region is in the range of from 50 to 100%.

53. A color filter comprising a colored layer as colored pixels provided on a transparent substrate, said colored layer containing a pyrrolo[3,4-c]pyrrole derivative produced by converting at least one ketopyrrole group in a pyrrolo[3,4-c]pyrrole of formula

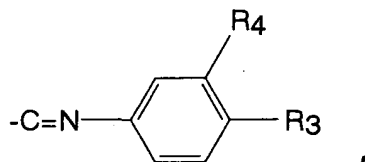


wherein A and B are each independently of the other a group of formula



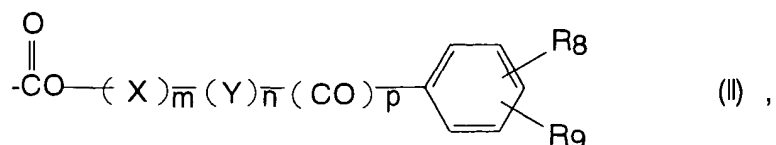


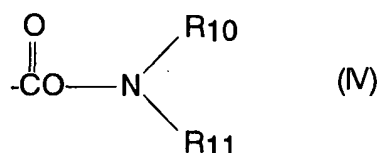
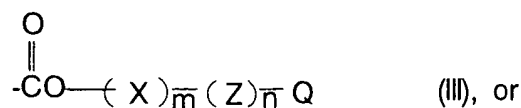
wherein R_1 and R_2 are each independently of the other hydrogen, halogen, C_1-C_{18} alkyl, C_1-C_{18} alkoxy, C_1-C_{18} alkylmercapto, C_1-C_{18} alkylamino, $-CN$, $-NO_2$, phenyl, trifluoromethyl, C_5-C_6 cycloalkyl, $-C=N-(C_1-C_{18} \text{ alkyl})$, a group of formula



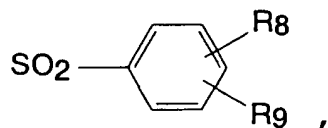
imidazolyl, pyrrazolyl, triazolyl, piperazinyl, pyrrolyl, oxazolyl, benzoxazolyl, benzothiazolyl, benzimidazolyl, morpholinyl, piperidinyl, or pyrrolidinyl; G is $-CH_2-$, $-CH(CH_3)-$, $-CH(CH_3)_2-$, $-CH=N-$, $-N=N-$, $-O-$, $-S-$, $-SO-$, $-SO_2-$, or $-NR_7-$; R_3 and R_4 are each independently of the other hydrogen, halogen, C_1-C_{18} alkoxy, or $-CN$; R_5 and R_6 are each independently of the other hydrogen, halogen, or C_1-C_6 alkyl; and R_7 is hydrogen or C_1-C_6 alkyl; and

D and E are each independently of the other a group of formula

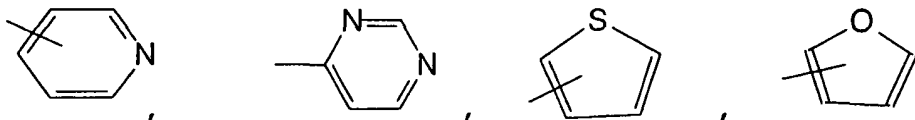


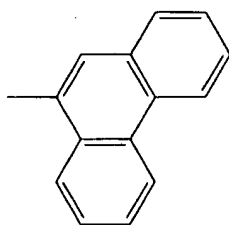
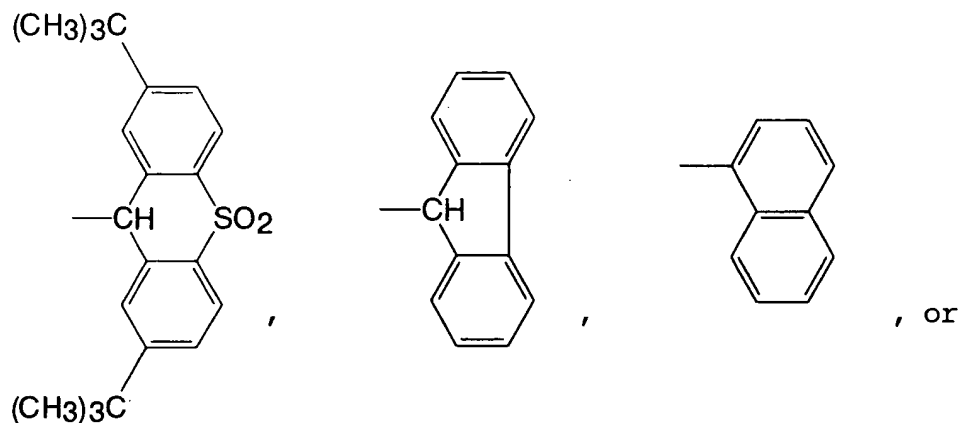


wherein, in the formulae (II), (III), and (IV), m , n , and p are each independently of one another a number of 0 or 1; X is C_1-C_{14} alkylene or C_2-C_6 alkenylene; Y is a group $-\text{V}-(\text{CH}_2)_q-$; Z is a group $-\text{V}-(\text{CH}_2)_r-$; V is C_3-C_6 cycloalkylene; q is an integer from 1 to 6; r is an integer from 0 to 6; R_8 and R_9 are each independently of the other hydrogen, C_1-C_6 alkyl, C_1-C_4 alkoxy, halogen, CN , NO_2 , unsubstituted phenyl or phenoxy, or phenyl or phenoxy which is substituted by C_1-C_4 alkyl, C_1-C_4 alkoxy, or halogen; and Q is hydrogen, CN , $\text{Si}(\text{R}_9)_3$, a group $\text{C}(\text{R}_{12})(\text{R}_{13})(\text{R}_{14})$ wherein R_{12} , R_{13} , and R_{14} are halogen, a group of formula



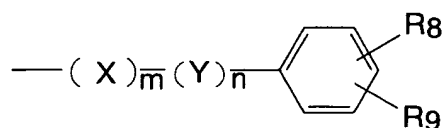
wherein R_8 and R_9 are as defined above, a group SO_2R_{15} or SR_{15} wherein R_{15} represents phenyl which is substituted by a C_1-C_4 alkyl, a C_1-C_4 alkoxy, or a halogen, or a group of formula





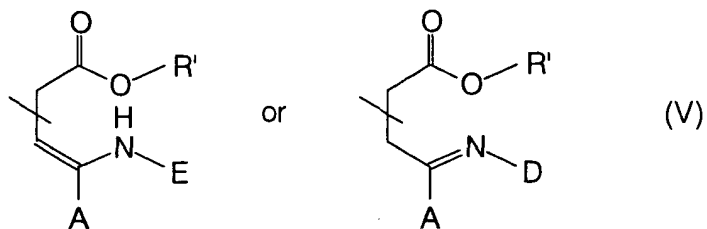
; and

R_{10} and R_{11} are each independently of the other hydrogen, $\text{C}_1\text{-C}_{18}$ alkyl, or a group of formula



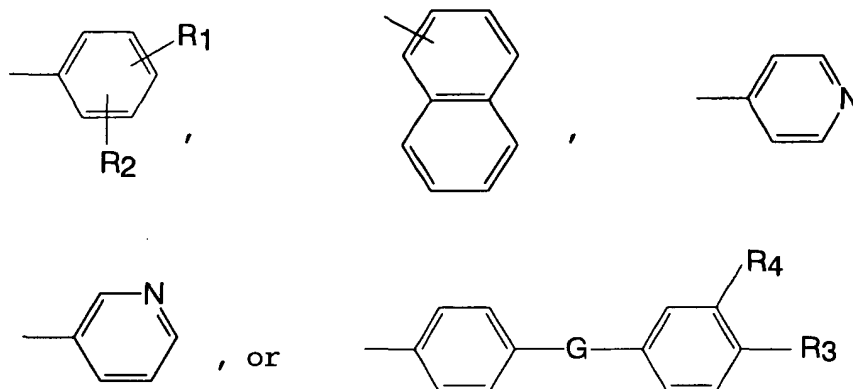
wherein X , Y , R_8 , R_9 , m , and n are as defined above, or R_{10} and R_{11} , together with the linking nitrogen atom, form pyrrolidinyl, piperidinyl, or morpholinyl radical; and D may be hydrogen, with the proviso that, if D and/or E are a group of formula (III), Q is hydrogen, and n is 0, m must be 1 and X must be a $\text{C}_2\text{-C}_{14}$ alkylene or $\text{C}_2\text{-C}_8$ alkenylene group which is branched at the carbon atom attached to the oxygen atom,

said at least one ketopyrrole group being converted to



wherein A may be B with the proviso that, if A is B, D is E; and R' is C₁-C₅ alkyl.

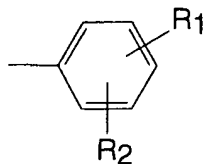
54. The color filter according to claim 53, wherein A and B in formula (V) are each independently of the other a group of formula



wherein R₁ and R₂ are each independently of the other hydrogen, chloro, bromo, C₁-C₄ alkyl, C₁-C₆ alkoxy, C₁-C₆ alkylamino, CN, or phenyl; G is -O-, -NR₇-, -N=N-, or -SO₂-; R₇ is hydrogen, methyl, or ethyl; and R₃ and R₄ are hydrogen.

55. The color filter according to claim 53, wherein A and B in formula (V) are identical to each other.

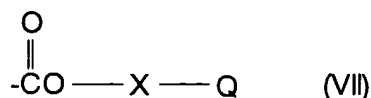
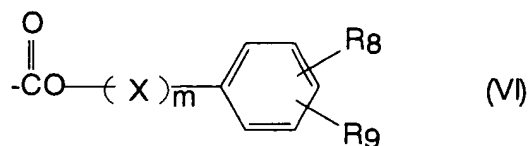
56. The color filter according to claim 55, wherein A and B in formula (V) are a group of formula



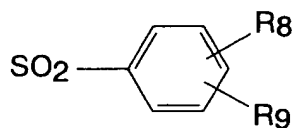
wherein R₁ and R₂ are each independently of the other

hydrogen, methyl, tert-butyl, chloro, bromo, CN, or phenyl.

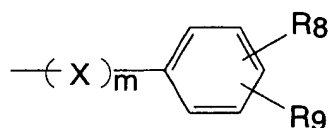
57. The color filter according to claim 53, wherein D is hydrogen or E, and E is a group of formula



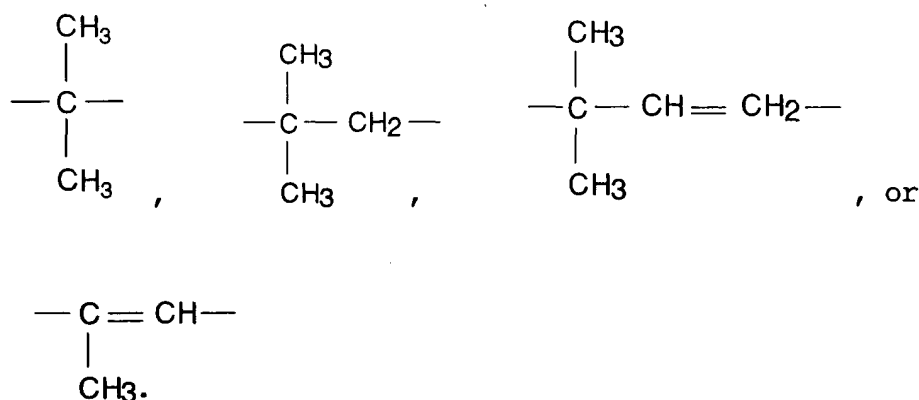
or formula (IV) wherein, in formulae (VI), (VII), and (IV), m is 0 or 1; X is C₁-C₄ alkylene or C₁-C₅ alkenylene; R₈ and R₉ are each independently of the other hydrogen, C₁-C₄ alkyl, methoxy, chloro, or -NO₂-; Q is hydrogen, CN, CCl₃, a group of formula



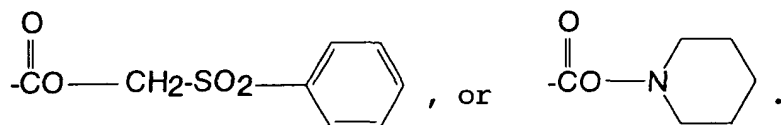
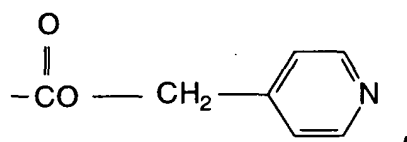
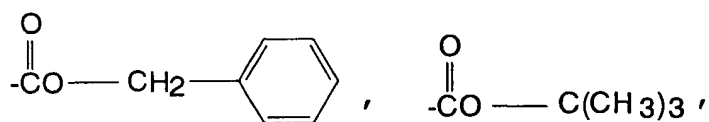
wherein R₈ and R₉ are as defined above, SO₂, SH₃, or SCH₃; R₁₀ and R₁₁ are each independently of the other hydrogen, C₁-C₄ alkyl, or a group of formula



or R₁₀ and R₁₁, taken together, form a piperidinyl radical, with the proviso that, if D and/or E are a group of formula (IX) and Q is hydrogen, X is a group of formula



58. The color filter according to claim 53, wherein D and E in formula (V) are identical to each other and are a group of formula



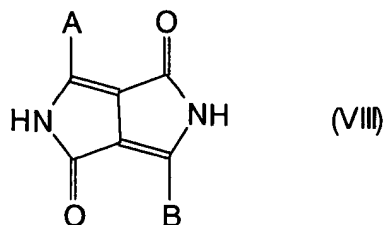
59. The color filter according to claim 53, wherein the pyrrolo[3,4-c]pyrrole derivative of formula (V) is produced by reacting the pyrrolo[3,4-c]pyrrole of formula (I) in a solvent including a lower alcohol and in the presence of a base as a catalyst.

60. The color filter according to claim 59, wherein the reaction is carried out at a temperature of 0 to 400°C, preferably a temperature of 20 to 200°C, for 2 to 80 hr.

61. The color filter according to claim 53, wherein the coloring material containing the pyrrolo[3,4-c]pyrrole derivative of formula (V) according to claim 53 is contained in

the colored layer.

62. The color filter according to claim 53, wherein the colored layer contains a coloring material containing as its component a pyrrolo[3,4-c]pyrrole of formula



wherein A and B are as defined in formula (I), which has been produced in situ by thermal decomposition, photolysis, or chemical decomposition of the pyrrolo[3,4-c]pyrrole derivative according to claim 53.